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THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station — Beltsville, Maryland

Volume 30 — May 15, 1946 — Number 5

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CHECK LIST REVISION

Freeman Weiss

PSORALEA (LEGUMINOSAE)

PSORALEA spp., SCURFPEA. Chiefly perennial herbs of prairies and plains in the Central and Western States. P. ESCULENTA Pursh, INDIAN BREADROOT (1) has edible tuberous roots; P. ARGOPHYLLA Pursh (2), P. CANESCENS Michx. (3), and P. MACROSTACHYA DC. (4) are of food value to wildlife; P. LANCEOLATA Pursh (5) and P. TENUIFLORA Pursh (P. floribunda Nutt.) (6) are useful in erosion control.

Actinonema psoraleae Ell. & Ev. (? Ascochyta), leaf spot. Kans. On P. digitata Nutt.

Cercospora latens Ell. & Ev., leaf spot. Kans. (2).

C. psoraleae Ray, leaf spot. Okla. On P. digitata Nutt.

Dicoccum psoraleae Ell. & Barth., on foliage and stems. Kans. (6).

Diplodina psoraleae Ell. & Barth. (Diplodinula p. Tassi), on dead stems. Kans. (6).

Erysiphe polygoni DC., powdery mildew. Mont. (6).

Gloeosporium psoraleae Pk., on leaves. Nebr. (1). G. psoraleae Kell. & Swing. on (3) in Fla. is a nomen nudum.

Microsphaera diffusa Cke. & Pk., powdery mildew. Wash. On P. physodes Dougl.

Parodiella griffithsii Theiss. & Syd., black mildew. Mont. (6). Collections in Colo., Kans., N.Mex., Okla., and S.Dak., referred to P. perisporioides may also belong here.

P. perisporioides (Berk. & Curt.) Speg., black mildew. Kans., Nebr., N.&.S.Dak. (2). Perhaps the preceding sp. rather than this.

Phyllosticta psoraleae (Cke.) Tassi, leaf spot. S.Car. (? 3).

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (6).

Puccinia andropogonis Schw. var. onobrychis (Burr.) Arth. (0,I), rust. On P. onobrychis Nutt., Ill. II and III on Andropogon spp.

Ramularia psoraleae Ell. & Ev., leaf spot. Calif. (4). Also on P. physodes Dougl., in Oreg.

Uromyces abbreviatus Arth. (0,III), rust. On P. physodes, Calif. and Wash.; on P. purshii Vail, Nev.; on P. sp., Ida.

U. psoraleae Pk. var. argophyllae (Seym.) Arth. (0,I,III), rust. On (2), (6), and other spp. from Minn. to Tex., Ariz. and Mont.

U. psoraleae var. typica Arth. On (5) and other spp. from S.Dak. to N.Mex., Ariz. and Oreg.

Septoria argophylla Ell. & Kell., leaf spot. Kans. (2).

S. psammophila Sacc., stem and ? leaf spot. N.Dak. (5).

S. umatillensis Sprague, leaf spot. Oreg. On S. lanceolata var. scabra (Nutt.) Piper.

PUERARIA (LEGUMINOSAE)

PUERARIA THUNBERGIANA Benth., KUDZU (1). Perennial vine of eastern Asia, introduced in the Southeastern States as a cover and soil-binding plant, becoming naturalized from Md. to Fla. and La. P. PHASEOLOIDES (Roxb.) Benth., TROPICAL KUDZU (2), is preferred for green forage.

Alternaria sp., leaf spot (secondary). N.J. (1)
Botryosphaeria ribis (Tode ex Fr.) Gross. & Dug., on dead stems. Ga. (1)
Diplodia puerariae Barth. (? Physalospora rhodina Berk. & Curt.) Cke.), on dead stems. Md. (1)
Fusarium sp., stem rot. La. (2)
Heterodera marioni (Cornu) Goodey, rootknot. Calif., Ga., Tex. General (1)
Macrophomina phaseoli (Maub.) Ashby, stem rot. Ga.
Phoma sp., on stems. La. (2)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (1)
Physalospora obtusa (Schw.) Cke., on dead stems. Va. (1)
Pseudomonas phaseolicola (Burk.) Dowson, halo blight. Conn. to Fla., La. and Ind. (1)
P. syringae van Hall, bacterial blight. N.J. (1)
Rhizoctonia microsclerotia Weber, web blight. Ga., Miss. Considered a form of Pellicularia filamentosa (Pat.) Rogers, as is the following.
R. solani Kuehn, damping off. Ala., Ga.

RHYNCHOSIA (LEGUMINOSAE)

RHYNCHOSIA spp. Perennial herbs, usually in sandy open ground in the Southern States and tropical America. Several spp. are of food value to wildlife.

Ascochyta rhynchosiae (Thuem.) Sacc., leaf spot. On R. simplicifolia (Walt.) Wood, S.Car.
Erysiphe polygoni DC., powdery mildew. On R. minima (L.) DC., P.R.
Heterodera marioni (Cornu) Goodey, rootknot. On R. intermedia Torr. & Gray. Fla.
Meliola bicornis Wint., black mildew. On R. reticulata DC., P.R.
Parodiella paraguayensis Speg., black mildew. On R. cinerea Nash, Fla.
P. perisporioides (Berk. & Curt.) Speg., black mildew. On R. reticulata, P.R.; R. simplicifolia, S.Car.; R. texana Torr. & Gray, Tex.; R. tomentosa (L.) Hook. & Arn., N.Car.
Phyllosticta rhynchosiae Miles, leaf spot. On R. erecta (Walt.) DC., Miss.
Synchytrium aecidioides (Pk.) Lagh., leaf gall, false rust. P.R., Virgin Is.

Rhynchosia cont.
Uromyces dolicholi Arth. (II,III), rust. On R. minima, P.R.; R. reticulata, P.R. R. texana, Tex. O and I unknown.

SCHRANKIA (LEGUMINOSAE)

SCHRANKIA UNCINATA Willd., SENSITIVE BRIER. Woody perennial of the Southeastern States; of food value to wildlife and sometimes grown for ornament.

Cercospora morongiae Tracy & Earle, on stems. Miss.
Ravenelia morongiae Long (II,III), rust. Tex.

SESBANIA (LEGUMINOSAE)

SESBANIA EXALTATA (Raf.) Cory, HEMP SESBANIA. Annual of South Central and Southwestern States, of food value to wildlife and sometimes grown for soil improvement. For S. vesicaria Elliott see Glottidium vesicarium below.

Anguillulina (? Pratylenchus sp.), root nema. Calif.
Botryosphaeria minor Ell. & Ev., on stems. La.
Diaporthe arctii (Lasch) Nits., on stems. La.
Erysiphe ? cichoracearum DC., powdery mildew. Calif.
Heterodera marioni (Cornu) Goodey, root knot. Calif., Tex.
Mycosphaerella sp. (Sphaerella sesbaniae Ell. & Ev.), on stems. La.
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.
Physalospora sesbaniae Ell. & Ev., on stems. La.
Pratylenchus pratensis (DeMan) Filip., root nematode. N.Car.; ? Calif.

GLOTTIDIUM (LEGUMINOSAE)

GLOTTIDIUM VESICARIUM (Jacq.) Harper, BAGPOD. Annual of the Southeastern States; furnishes food for wildlife.

Cercospora glottidiicola Tracy & Earle, leaf spot. Miss.
Erysiphe polygoni DC., powdery mildew. Fla.
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.

SOJA (LEGUMINOSAE)

SOJA MAX (L.) Sieb. & Zucc., SOYBEAN. Annual of eastern Asia, long cult. there for edible seeds and forage; for many years grown in the Southern States as a forage and soil-building crop, and more recently extensively cult. in the Corn Belt for hay, oil, and edible seeds.

Soja max cont.

Alternaria spp., leaf spot (mostly secondary). Widespread. A. atrans Gibson (? A. tenuis Nees ex Wallr.) on leaves injured by sunburn, insects, and bacterial blight, reported in Ariz., N.Y., Pa.; A brassicae (Berk.) Sacc. f. phaseoli Brun., in Md.; A. tenuis Nees ex Wallr., secondary leaf spot in N.Car., isolated from seeds in Minn.

Aspergillus spp., on seed, especially immature seed or of high moisture content. Reported from Ill. and Minn. but probably cosmopolitan. A. flavus Lk. ex Fr., A. glaucus L. ex Fr., and A. ochraceus Wilhelm predominated; A. fumigatus Fres. and A. niger v. Tiegh. also were found. A. flavus impaired vitality and germination.

Ascochyta sp., on leaves. Ark., W.Va.

(Bacterium glycines (Nakano) Elliott, and B. phaseoli E. F. Sm. var. sojense Hedges): Xanthomonas phaseoli var. sojense.

(B. glycineum Coerper, and B. sojae Wolf): Pseudomonas glycinea.

Botryodiplodia pallida Ell. & Ev. (? Physalospora rhodina (Berk. & Curt.) Cke.); on stems. Ala.

Botrytis cinerea Pers. ex Fr., gray-mold leaf spot, shoot blight. Conn., Ohio.

Cercospora canescens Ell. & G.Martin (? C. cruenta Sacc., Mycosphaerella C. (Sacc.) Latham), leaf spot, also on pods and stems. Ala., Ill., Md., Miss., N.Car., W.Va.

C. sojina Hara (C. daizu Miura) frog-eye leaf spot. N.Y. and Mich. to Fla., Okla., and Iowa.

Cercosporina kikuchii T. Matsu & Tomoyasu, purple speck (of seed); also leaf spot. Ind., Md., N.Car., Va.

Colletotrichum sp., leaf and stem spot (? secondary). La.

(C. glycines Hori): Glomerella glycines

Diaporthe sojae Lehman (D. phaseolorum (Cke. & Ell.) Sacc. var. sojae (Lehman) Wehm.), pod and stem blight. N.Y. and Mich. to Ga., La., and Kans.

Ditylenchus dipsaci (Kuehn) Filip., stem nematode. N.Y.

Erysiphe polygoni DC., powdery mildew. Del., Iowa, N.&S.Car., P.R.

Fusarium oxysporum Schlecht. f. tracheiphilum (E.F.Sm.) Snyder & Hansen. (F. bulbigenum Cke. & Mass. var. tracheiphilum (E.F.Sm.) Wr.), Fusarium wilt, blight. Pa. to Fla., La., Tex. and Nebr.; also Calif. Unidentified Fusarium spp. have been reported associated with root, stem, and pod rots of soybeans, and impaired seed vitality.

F. scirpi C. R. Lambert & Fautry var. acuminatum (Ell. & Ev.) Wr., seed rot. N.Dak.

Glomerella glycines (Hori) Lehman & Wolf, anthracnose. N.Car. and Mich. to Fla., Tex. and Nebr.

G. cingulata (Ston.) Spauld. & Schrenk., on stems. N.Car.

Helminthosporium vignae L.S.Olive, zonate leaf spot. N.Car.

Heterodera marioni (Cornu) Goodey, root knot. Va. to Fla. and Tex.; Ariz., Calif., Hawaii.

Soja max cont.

Macrophomina phaseoli (Maub.) Ashby (Sclerotium bataticola Taub.), ashy stem blight, "leopard" spot on leaves and pods. N.J. to S.Car., Tex. and Nebr.

Microsphaera sp., powdery mildew. N.Car.

Mycosphaerella cruenta (Sacc.) Latham, leaf spot. Ga., Miss.

Myrothecium roridum Tode ex Sacc., secondary leaf spot. La.

Nematospora coryli Pegl., yeast spot (on seeds). N.&S.Car., Okla., Va.

Neocosmospora vasinfecta (Atk.) E.F.Sm., on stems. Ga.

Pellicularia filamentosa (Pat.) Rogers (Rhizoctonia solani Kuehn), root and stem rot, canker.

Peronospora manshurica (Naum.) Syd., downy mildew. Eastern and Southern States to La. and Iowa.

Phoma sp., on stems. Ill. P. subcircinata Ell. & Ev., S.Car.

(Phomopsis sojae Lehman): Diaporthe sojae.

Phyllosticta glycinea Tehon & Daniels, leaf spot. Ill., Md., N.Car., Va.

? P. phaseolina Sacc., leaf spot. Ga., N.Car.

(P. sojaecola Massal.): Pleosphaerulina sojaecola.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.

Pleosphaerulina sojaecola (Massal.) Miura, leaf spot. Md., N.J., N.Y., Wis.

Pseudomonas glycinea Coerper, bacterial blight. Eastern and Southern States to Tex. and Minn.

P. solanacearum E.F.Sm., bacterial wilt. N.Car.

P. tabaci (Wolf & Foster) Stapp, wildfire. Md. to Ala., La., and Nebr.

Pythium spp. (commonly reported as P. debaryanum Hesse), damping off, root rot. Ill., Iowa, Minn., Mo., N.Car., N.Dak.

Rhizobium leguminosarum Frank em. Baldwin & Fred (more particularly the strain identified as R. japonicum (Kirchner) Buchanan), in root nodules. General.

Rhizoctonia sp. (R. solani Kuehn), root rot, stem canker. See Pellicularia filamentosa.

Sclerotinia sclerotiorum (Lib.) DBy., stem rot. Md., Iowa, N.Y., Va.

(Sclerotium bataticola Taub.): Macrophomina phaseoli.

S. rolfsii Sacc., southern blight. Va. to Fla., Tex., and Iowa.

Septoria glycines Hemmi, brown spot. Ark., Del., Ind., Iowa, Md., N.Car., Wis.

Sphaceloma sp., leaf and stem spot. Pa.

Xanthomonas phaseoli (E.F.Sm.) Dowson var. sojense (Hedges) Starr & Burk., bacterial pustule, pustular spot. General.

Baldhead -- loss of seedling growing point attributed to mechanical injury of seed, perhaps complicated by Pythium infection. Iowa.

Bud blight (streak, leatherneck) -- virus (Marmor annularium McK., Nicotiana virus 12 K.M.Sm.). Ohio to Ark., Nebr., and Minn.

Soja max cont.

Curly top -- virus (Chlorogenus eutetticola Holmes, Ruga verrucosans Carsner & Bennett, Beta virus 1 K.M.Sm.). Oreg., Wash.

Mosaic -- virus (Soja virus 1 K.M.Sm.). General. This is the common seed-borne virus of soybeans. The following viruses have been shown experimentally infectious to soybeans: alfalfa mosaic, southern and yellow mosaic of bean, lima bean mosaic, enation mosaic of pea, and pea streak. Infection by one or more of these viruses may account for the variable symptoms--mottle, crinkle, stunt, and streak--described for soybean mosaic.

Yellowing -- physiological, frequently due to potassium deficiency. Occasional in Eastern States. Yellowing resulting from deficiency of iron or of nitrogen also is reported.

STIZOLOBIUM (LEGUMINOSAE)

STIZOLOBIUM DEERINGIANUM Bort, FLORIDA VELVETBEAN (1). Coarse twining annual of tropical Asia, grown in the far South as a forage and cover crop. S. PRURITUM (Wight) Piper, COWAGE V. (2), endemic in tropical America, is similarly used.

Bacterium stizolobii (Wolf) McCul., bacterial spot. N.Car. Of the Pseudomonas group but this combination not yet made. See also Pseudomonas syringae.

Cercospora mucunae Syd., leaf spot. P.R. (2).

C. stizolobii Syd., leaf spot. Ala., Fla., Ga., N.&S.Car. (1); P.R. (1,2).

Fusarium sp., pod spot. Tex., P.R.

Heterodera marioni (Cornu) Goodey, root knot. Calif. In general velvetbeans are highly resistant to root knot and some vars. are apparently immune; they are commonly grown as root-knot immune crops in rotations. Slight infection of certain vars. is reported in Hawaii. Also reported on (2) in ? Miss.

Mycosphaerella cruenta (Sacc.) Latham (Cercospora cruenta Sacc.), leaf spot. Ga.

Phyllosticta mucunae Ell. & Ev., leaf spot. Ala., Hawaii.

Phymatotrichum omnivorum (Shear) Dug., root rot. Ariz., Tex.

Phytophthora parasitica Dast., root rot. Fla.

Pseudomonas syringae Van Hall, bacterial spot. Ind. (1).

Rhizoctonia solani Kuehn, stem rot. Ga., La.

Sclerotium rolfsii Sacc., southern blight. Ala., Fla., Ga.

Mosaic -- unidentified virus. Ind.

Yellowing -- zinc deficiency. Fla.

STROPHOSTYLES (LEGUMINOSAE)

STROPHOSTYLES HELVOLA (L.) Britton (1), S. PAUCIFLORA (Benth.) S. Wats. (2), and S. UMBELLATA (3), WILD BEAN. Annual (1,2), or perennial (3), trailing vines of sandy plains and open woods in the Eastern and Southern States to the Western Plains; of food value to wildlife.

Cercospora cruenta Sacc. (=Mycosphaerella cruenta (Sacc.) Latham), leaf spot. Ill. (1)
Erysiphe polygoni DC., powdery mildew. Minn., Mo. (1), Okla. (2).
Macrophomina phaseoli (Maub.) Ashby, ashy stem blight. Ga. (1).
Parodiella perisporioides (Berk. & Curt.) Speg., black mildew. Va. (1).
Phomopsis sojae Lehman (=Diaporthe phaseolorum (Cke. & Ell.) Sacc. var. sojae (Lehman) Wehm.), stem blight. Ga.
Phyllosticta phaseolina Sacc., leaf spot. Iowa., Kans., N.J., Ohio, Okla., Wis. (1); Kans., Nebr., Tex. (2).
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.
Uromyces phaseoli (Pers.) Wint. var. strophostyles Arth. (0,I,II, III), rust. R.I. to Ala., Okla., Nebr. and Wis. (1); N.J. to Miss., Tex., and S.Dak. (2); Ind., Mo., N.Car., Pa. (3).
Xanthomonas phaseoli (E.F.Sm.) Dowson, bacterial blight. Ind. (1).

Mosaic -- unidentified virus. Ind.

TEPHROSIA (LEGUMINOSAE)

TEPHROSIA spp., GOAT'S-RUE, chiefly T. SPICATA (Walt.) Torr. & Gray (1), T. VIRGINIANA Pers. (2), and others (3). Herbaceous or somewhat shrubby perennials of dry, sandy plains or open woods, chiefly southern except (2) which occurs throughout the Eastern and Central States; of food value to wildlife, (2) contains rotenone.

Cercospora tephrosiae Atk., leaf spot. Ala. (1).
Parodiella perisporioides (Berk. & Curt.) Speg., black mildew. Fla. (3).
Ravenelia caulicola Arth. (II,III), rust. On T. cinerea (L.) Pers., P.R.
R. epiphylla (Schw.) Diet. (0,I,II,III), rust. Ala., Fla., S.Car. (1); Conn. to Fla., La., and Wis.

THERMOPSIS (LEGUMINOSAE)

THERMOPSIS spp., GOLDENPEA, BUSH-PEA. Perennial herbs, chiefly of plains and open ground, different spp. ranging widely in the

Thermopsis cont.

U.S.; sometimes grown for ornament and of food value to wildlife.

Cercospora thermopsidis Earle, leaf spot. Colo., Mont.
Erysiphe polygoni DC., powdery mildew. Rocky Mountains and Pacific Northwest.
Macrophoma thermopsidis (Ell. & Gal.) Sacc. & Syd., on stems. Mont., ? Colo., N.Mex.
Phoma thermopsidicola P. Henn., leaf spot. Calif.
Ramularia sphaeroides Ell. & Ev., leaf spot. Wash.
Stigmina thermopsidis Harkn., leaf spot. Calif.

DIVISION OF MYCOLOGY AND DISEASE SURVEY

THE SCLEROTINIA ROT DISEASE OF BEANS IN IDAHO[1]

Earle C. Blodgett[2]

Introduction

The State of Idaho, since about 1920, has played a prominent role in the production of field or dry beans and in recent years also in garden seed beans. Murphy (9) summarized the status in 1940, but war emergency programs have changed the situation somewhat and in Table 1 are shown the main producing areas, the approximate acreages, and in general the types of beans grown.

During the plant disease survey in 1943 on crops in southern Idaho conducted by the Emergency Plant Disease Prevention Project of the U. S. Department of Agriculture, it was found that Sclerotinia rot of beans caused by Sclerotinia sclerotiorum (Lib.) de Bary, had aroused considerable concern and that it was more serious than anyone had anticipated (7). Surveys were continued during the winter of 1943-44 and again in 1944-45 by following up reports of affected fields and by noting the presence of sclerotia in lots being processed. The history, distribution, and potential seriousness of this disease indicate the desirability of recording the information.

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[1] The data presented herein were secured by the Emergency Plant Disease Prevention Project, U.S. Dept. of Agriculture, in cooperation with the Department of Plant Pathology, Idaho Agricultural Experiment Station, Moscow, Idaho and published with the approval of both cooperating agencies.

[2] Plant Pathologist, Emergency Plant Disease Prevention. The writer wishes to express his sincere appreciation to all cooperators, especially the managers and foremen of bean-processing plants, for their help in sampling the bean lots and furnishing information.

Table 1. Acreages of garden beans and field beans with total and principal types grown in twenty counties of Idaho during 1942, 1943, 1944.[a]

County	Garden beans 1942	Field beans 1942	Total beans 1942	Total beans 1943	Total beans 1944	Principal types in estimated order of importance[b]
Bingham	1,753	547	2,300	3,800	2,500	G.V.,P.
Bannock	12	88	100	100	---	P.,G.V.
Minidoka	1,117	6,883	8,000	12,000	11,500	P.,G.N.,G.V.
Cassia	486	5,214	5,700	8,500	8,000	G.N.,P.,G.V.
Jerome	3,941	19,659	23,600	26,500	25,000	G.N.,G.V.,P.
Lincoln	19	1,181	1,200	1,400	1,500	G.N.,P.
Twin Falls	17,503	52,997	70,500	76,000	67,000	G.N.,S.R.,G.V.,P.
Gooding	11	7,589	7,600	11,900	11,000	S.R.,G.N.,G.V.
Elmore	40	760	800	1,200	1,200	S.R.,G.N.,G.V.
Ada	44	56	100	400	200	D.L.,G.N.
Canyon	5,250	---	5,250	4,400	3,200	D.L.,G.N.
Owyhee	---	300	300	800	200	G.N.
Gem	---	---	---	100	---	G.N.
Payette	4	496	500	700	500	G.N.
Washington	---	---	---	100	---	G.N.
Lewis	---	2,000	2,000	2,300	500	S.W.,S.R.
Clearwater	---	1,500	1,500	2,300	1,200	S.W.,P.,S.R.
Nez Perce	123	6,377	6,500	10,800	7,000	S.W.,P.,G.V.,S.R.
Idaho	---	300	300	200	---	S.W.
Latah	---	4,800	4,800	8,200	5,400	S.W.,S.R.,G.N.
State total	30,303[c]	123,697	154,000	172,000		

[a] These figures were furnished through the courtesy of Richard C. Ross, Agr. Statistician, Bur. Agr. Econ., Div. of Agr. Statistics, U.S. Dept. of Agr., Boise, Idaho. The divisions between groups of counties correspond to "areas" in the State.

[b] G.V. = Garden Variety, P = Pinto, G.N. = Great Northern, S.R. = Small Red, D.L. = Dwarf Lima, S.W. = Small White.

[c] The estimated state acreages of garden beans for 1943 and 1944 are 34,000 and 38,000 respectively.

History of the Disease

The literature on Sclerotinia rot of beans in the United States is meager and fragmentary, and until recently the disease apparently was not considered very important since little or no mention was made in general bulletins or publications, even by Harter and Zaumeyer (4), until 1944 when Harter and Zaumeyer (5) briefly reviewed the literature and discussed Sclerotinia wilt. Morris (8), however, called attention to severe losses on Great Northern beans in Montana in 1941. W. J. Zaumeyer, in personal correspondence, stated that he observed Sclerotinia rot in the vicinity of Billings, Montana, in 1943 and that he and Dr. Harter "about ten years ago, noted a field of garden beans quite heavily infected with the same disease in Montana". Reinking (10) reported that the rot was severe in two localities in New York in 1940, Zaumeyer further stated that Sclerotinia rot was known to be very serious in 1942 near Homestead, Florida. Townsend (11) described the disease as a watery soft rot on beans in Florida and reported information on rotation. Hyre (6) indicated the presence of the disease in Florida in the winter season of 1943-44, while Brooks et al (2) in 1945 states that the disease has become of increasing importance in three counties of Florida. Brief mention of losses has been made from other States.

So far as is known, the first report of Sclerotinia rot of beans in Idaho was made in 1941 by Anderson (1), who correlated its presence with an unusually rainy, cloudy season. He states that "Sclerotinia rot was found sparsely in several fields (near Jerome) and in one field at Kimberly considerable damage resulted with complete rotting of vines and the formation of numerous, well formed sclerotia". It is of interest to note that the fields mentioned by Anderson in 1941 included the farm about which the county agent (Jerome County) in September, 1943, wrote as follows: "I have sent you some bean plants taken from a field from which 75 to 80% of the beans have died, due to some cause which we are unable to determine. . . . it seems to exist under various conditions, some fields being rather flat and others a steep slope. The condition occurred last year in a few fields and caused some loss. This year there is a large infestation and it appears that the loss will be considerable . . .".

During the survey the writer noted several interesting ideas regarding the supposed cause of the disease. Some bean men believed that the sclerotial bodies were a special kind of weed seed, others considered them to be "petrified blossoms" which fell to the ground. One processor thought the odd-shaped sclerotia were formations of dirt around the openings of the sieves in harvesting equipment, while one grower considered the sclerotia as charred beans where a bean straw stack had burned, and others thought the sclerotia were mouse signs. The most bizarre explanation was that since the sclerotia were most prevalent in sheep feed lots and lambing sheds (where cull beans

had been fed) that they were the remains of lamb and sheep teeth.

The evidence from growers, bean dealers, and field men indicatesthat the Sclerotinia disease as a significant factor dates back to about 1940 and has rather rapidly assumed importance.

Varieties Affected

Under favorable conditions probably all the common bean varieties may become infected. The writer has seen the disease in the field or found sclerotia in the harvested beans of the following varieties or types: Great Northern, Pinto, Small Red, Bountiful, Kentucky Wonder, Florida Belle, Plentiful, Brittle Wax, Burpee Stringless (Landreth Stringless), and Thorogreen Dwarf Lima. M. E. Anderson, located at Idaho Falls, told the writer that the Giant Stringless was severely infected and that the Refugee was the most commonly affected variety of garden beans, probably because of the extensive vine growth and dense foliage. Reinking (10) reported that Idaho Refugee and Red Kidney were severely affected in New York. Extremely severe loss has been noted in Great Northern, Small Reds, and Pintos, and rather heavy loss in Bountiful, but the other varieties noted by the writer were moderately infected or showed bare traces. The viny type plants, because they shade the ground and produce a condition of high humidity, are in general more severely affected than are the bush beans. Some bush beans, however, have dense foliage and make an almost complete covering of the soil, such as the Refugee types which are commonly infected.

Symptoms

Affected tissues become water-soaked and soon rot completely, forming a white moldy growth on the surface of stems, pods, vines, and leaves (fig. 1, D, F). Infected parts become slimy and watery but they later dry out, becoming light, punky tissue that is characterized by severe retting and disintegration. In many cases rotting pods and petioles showed numerous droplets of a sticky, tan-colored exudate

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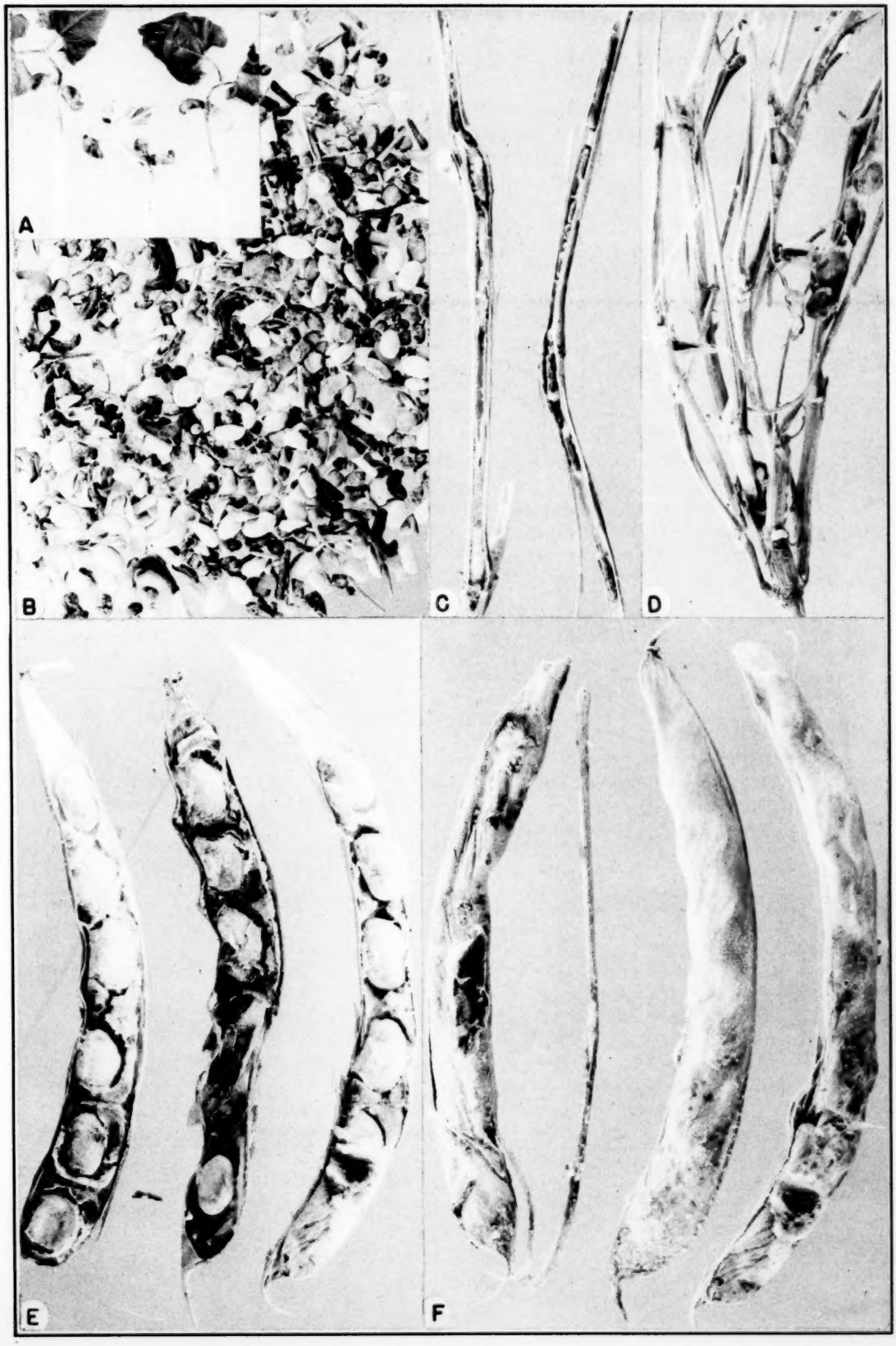
FIG. 1. Sclerotinia Rot of beans. A. Rot of seedlings at cotyledonary node. B. Sclerotia in cull beans, natural occurrence. C. Sclerotia inside bean stalks and vines. D. Infected bean plant showing tufts of mold, diseased beans, and sclerotium (upper left). E. Infected pods, showing sclerotia forming around diseased beans. F. Infected pods and vine showing droplets of tan colored, sticky exudate often associated with Sclerotinia rot.


A
B
C
D
E
F

which appeared similar to that associated with certain bacterial diseases. It is possible that the exudate merely consists of droplets of water liberated from affected tissue (Fig. 1, F). The fungus may proceed up the stem usually from near or above the soil level from any tissue touching the ground, or from contacting diseased portions. In heavy growth the entire lower portions become a slimy mass.

Later, or with the development of rot, sclerotia form, either inside taking up unused spaces and hollow stems or on the outside of any part of the plant above ground (Fig. 1, C,E,). The sclerotia that form inside the pods and around the beans show strange shapes and variations in size and appear much like alphabet macaroni in shape (Fig. 2, G,H). The bodies that form inside the stems and vines are slender, elongated bodies with a finely ridged appearance (Fig. 2, H top), while large, irregularly-shaped sclerotia form on the outside of infected organs (Fig. 2, H center).

Bean seeds themselves, if they form in diseased pods, are attacked by the fungus and become dull, lifeless, and chalky in appearance (Fig. 2, E,F). The outer skin is destroyed, exposing the porous cotyledons which are usually much lighter than normal. It is fairly easy to differentiate infected beans from those discolored by water stain or other factors. Beans developing on partially affected plants usually are light and shriveled and clean out with the culls. Cases have been seen in which sclerotia are still attached to infected beans (Fig. 2, B).

Bean samples collected during the survey showed evidence in germination of an unusual rotting of the young bean plants at the cotyledonary node. (Fig. 1,A). This injury was first noted by Leslie Dean (Formerly Bean Improvement Program, State of Idaho) and Glenn KenKnight (University of Idaho) who continued some of the tests begun by the writer and took the photograph presented in Figure 1, A. They were successful in isolating Sclerotinia from typical lesions. This evidence indicates that bean stands might be reduced by this disease especially during wet seasons.

Seed Transmission

Since seed beans are grown extensively and are shipped throughout the country and interchange of field bean seed within the State is common, it seemed desirable to consider seed transmission. Doyer (3) has already called attention to this factor. From a lot of Bountiful seed heavily infested with sclerotia, one sample showing evidence of infection was selected and placed in a moist chamber in a refrigerator (Fig. 2, A,B,C). In about three weeks the infected beans showed abundant mycelial growth and sclerotial formation of the fungus (Fig. 2, D).

It is very likely that a few diseased beans and sclerotia may pass the usual screening process or even hand-picking. Sclerotia are reported, although rarely, in samples sent to grading laboratories. This seed transmission may provide a means for introducing the fungus into widely separated areas and eventually building up infestation.

Results of the Survey 1943-44, 1944-45

Since field examination of beans over a wide territory within a short time was not feasible, a simpler method of sampling for Sclerotinia rot was desired. Trial examinations made on lots of beans from known fields noting the beans "in the rough", in cleanings and in cull piles showed that the prevalence of sclerotia in the samples was a reasonably accurate indication of field conditions as regards infection and loss. Although no standard sampling technique has been perfected, the writer feels that in general a fairly accurate picture has been obtained. A total of 67 bean processing plants located in the towns of Blackfoot, Rupert, Declo, Burley, Milner, Murtaugh, Hansen, Hazelton, Eden, Twin Falls, Filer, Buhl, Kimberly, Jerome, Wendell, Gooding, Boise, and Nampa were examined. The beans processed in these plants were in most cases grown in the near vicinity, although some interchange between areas occurred.

Discussion

The data presented indicate quite conclusively that an important disease of beans is already widespread in the main bean-growing section of Idaho. Growers and dealers generally are not familiar with the disease nor with its potential seriousness. Sclerotinia rot evidently has spread rather rapidly into new areas, and it is certain that infested patches in many fields have become greatly enlarged and more severely affected. The use of combines and the practice of feeding the straw and subsequent use of the litter has spread the sclerotia. One of the most likely methods of introducing the fungus into new fields and farms is the very common practice of feeding cull beans

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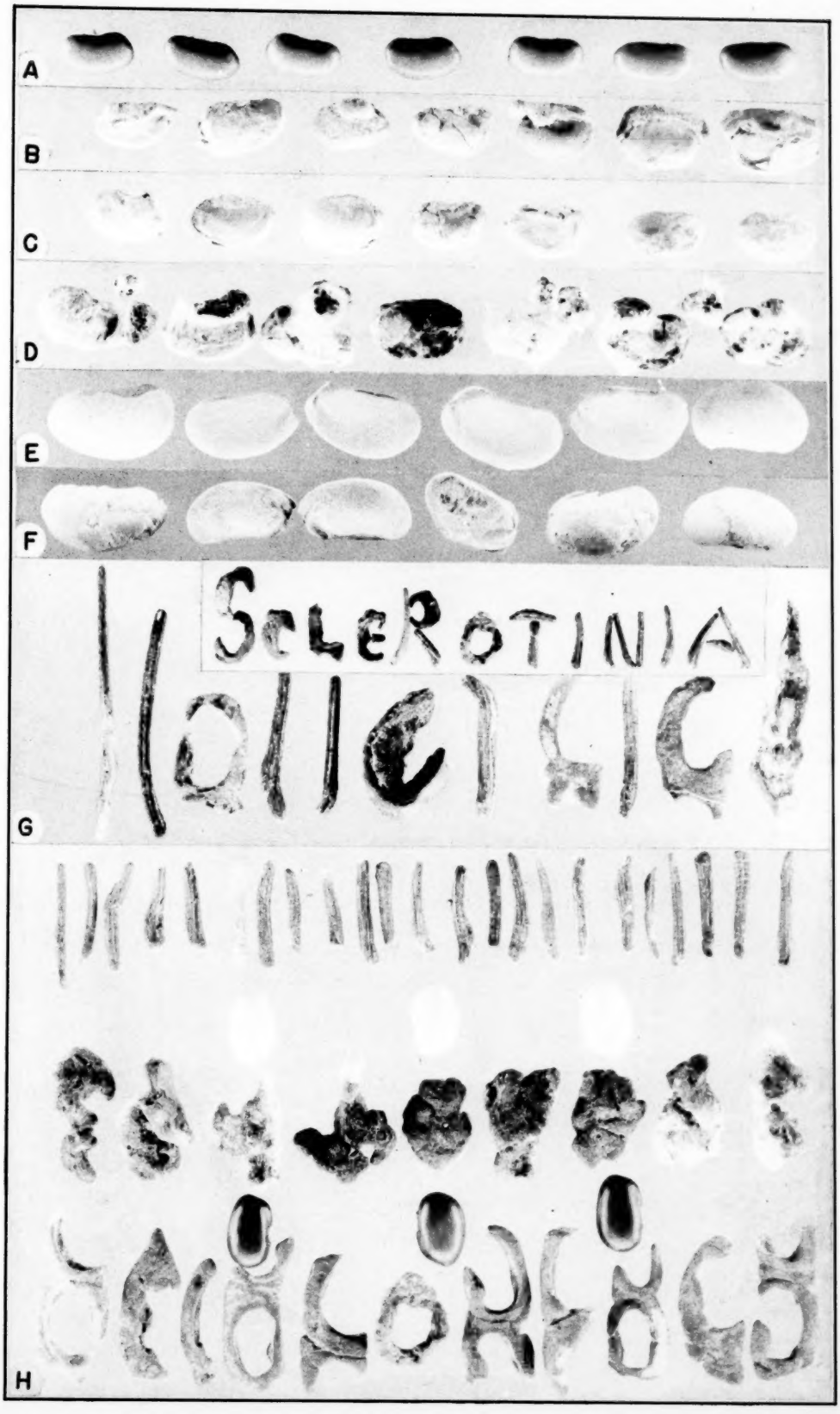
FIG. 2. Sclerotinia Rot of Beans. A. Healthy Bountiful beans. B. Infected Bountiful beans showing attached sclerotia. C. Infected Bountiful beans, but no sclerotia attached. D. Same beans as in C, but after three weeks in a moist, cool place. E. Healthy Great Northern bean halves. Note solid, clear tissue. F. Infected Great Northern bean halves. Note punky, porous tissue. G. Sclerotia from beans. The longest sclerotium is 1 7/16" in length. H. Sclerotia from beans. The slender bodies formed in the vines, the heavy pieces on the pods or stalks and the odd-shaped pieces inside the pods and around the beans.


A
B
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SCLEROTINIA
G
H

to sheep. In feed lots it is possible to pick up great quantities of well-preserved sclerotia. It has been pointed out that bean growers who are sheep men may have more Sclerotinia rot on beans than their neighbors. These factors and the dangers of seed transmission should have a bearing on control measures. Since the fungus is soil-borne, careful attention should also be given to sound rotations with special caution against growing beans too often. A situation evidently can develop, and has already developed on some farms, where good land has been made useless, at least temporarily, for bean growing.

In northern Idaho one of the county extension agents stated that Sclerotinia rot was first noted in 1941. At that time it was reported in small spots in fields devoted to rape seed production. In another field, in this area, seeded in 1943 with Small Red beans from southern Idaho, there was spotted injury from Sclerotinia. This particular field had been in wheat in 1942 and in alfalfa (for seed) for several years previously. It is not known whether the infection noted came from diseased rape or from infected seed beans.

The records of the survey and comments of processors indicate that the amount of Sclerotinia was perhaps slightly less in 1944 than in the previous season. Weather conditions were generally unfavorable to the fungus, and in addition root rot in many fields tended to reduce vine growth. The apparent freedom from the disease in the new areas probably indicates that insufficient time has elapsed to build up noticeable infestation. There are, however, local districts in certain areas where Sclerotinia apparently does little damage because of the following factors: low fertility of the soil, sandy, open type soil, and insufficient water. These factors tend to prevent heavy vine growth and high humidity and less infection results so that infestation is slow to build up.

Considerable work is needed to determine the relationship existing among the various crops and the Sclerotinia fungus which affects them so that proper recommendations for rotation may be made. The crops most commonly affected are beans, carrots, peas, and rape.

Summary

Idaho is an important State in production of dry beans (Great Northern, Small Red, Pinto) and garden seed beans including pole and bush beans of many types. A table is presented to show bean-producing areas and approximate acreages of various types.

Sclerotinia rot of beans as an important disease is comparatively new to the United States and certainly in Idaho where it was first reported in 1941.

Symptoms of Sclerotinia rot on beans are a soft watery rot of

affected tissues and development of white mold and black sclerotia. All types of beans are affected, though apparently garden seed beans are less susceptible.

A seedling rot and seed transmission are reported. Evidence gained from extensive surveys indicate that the disease is widespread in the bean areas, particularly in the older sections, and is most severe near Kimberly, Castleford, and Jerome.

General comments are made on the disease, its importance, and factors in control are discussed.

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EMERGENCY PLANT DISEASE PREVENTION PROJECT AND IDAHO AGRICULTURAL EXPERIMENT STATION

OBSERVATIONS ON SOME BOTRYTIS DISEASES IN CALIFORNIA

Kenneth F. Baker

Botrytis cinerea Pers. frequently causes economic loss of plants outdoors and under glass in coastal California. Observations on some of the spectacular or consistently damaging examples are here reported, with some additional casual records.

It generally is agreed that infection by Botrytis requires a period of high humidity or rain, and low or moderate temperatures, usually coupled with the presence of some dead or senescent tissue. It has been found (2,9,10,17) that the fungus grows best in culture or in various hosts at 72.5-77°F, but that it grows freely even at 41°F and slowly at 32.0-35.6°F, thus meriting its reputation as a low-temperature organism. It is inhibited at 86-95°F. The fungus grows well through more than a 30° range below, and a 10-15°F range above its optimum. Botrytis was not found (9) on carrots at temperatures above 76.1-82.4°F and was most common (8) on pepper fruits below 55.4°F. An epiphytotic on strawberry fruits in Washington, D. C. occurred during a rainy period when daily temperatures ranged from a minimum of 48-57°F to a maximum of 57-76°F (16). In a California outbreak on orange fruit (4) there was a rainy period with a mean temperature of 55.4°F. Lettuce plants in tests (1) were heavily watered in cold frames at 33.8-59.0°F and in a greenhouse at 64.4°F. They had, respectively, 36.8 and 1.8 percent loss in one variety and 68 and 14 percent in another. Thomas (18) reported an epiphytotic of fruit and stem rot of tomatoes in a glasshouse held at 75-80°F with high humidity, but severe Botrytis losses at such temperatures are unusual. There has been little study of the relative humidity favorable for infection. Lauritzen (9) found small variation in the amount of infection of carrots over the 70-90 percent range, but field observations and reports suggest a marked increase of the disease as humidity approaches saturation.

Epiphytotic, Winter of 1940-41

Although coastal southern California lies in a semi-arid region there are certain factors which often make the environment favorable for Botrytis outbreaks. Rain occurs largely from November through April and is heaviest in January and February; in Los Angeles 13.54 of the average 14.76 inches occur during those 6 months. The mean monthly temperatures for Los Angeles during that period range from 54.6 to 60.9°F, reaching the lowest level in January and February. Such temperatures are favorable for Botrytis. As Stevens has pointed out (17), it is not surprising that outbreaks occur there during the winter months. The winter of 1940-41, in which there were 32.75 inches of rain from October through April (12.42 in February alone),

was such a period. Botrytis was quite common on woody shrubs and perennials, but few annuals were planted at that season.

Euphorbia. The colored bracts of poinsettia commonly are attacked by Botrytis outdoors, especially in rainy weather. Such losses were very common in the Los Angeles area during the winter of 1940-41, the infections often working back and causing a shoot blight. In most seasons protracted periods of rain do not set in until after the holidays, and commercial outdoor plantings thus escape loss. In gardens the bracts, particularly of the double varieties, remain until the rainy season and are frequently disfigured. This situation is at variance with that reported by Spaulding (15) in which the leaves, but not the bracts, were infected. Peltier (14) later observed infections of the colored bracts in the same greenhouses, and found that the fungus infected the flower clusters through the sticky stigmatic surfaces, causing them to fall.

Gardenia. A Botrytis bud and twig rot occurred on outdoor plants in Riverside in February, 1941, producing dark brown lesions.

Jasminum mésnyi. Woody stems of this plant in West Los Angeles were girdled in April, 1941 by Botrytis advancing from old, dead, infected twigs.

Lycopersicon. Greenhouse tomatoes grown in water culture at Montebello were observed to sustain very heavy losses from Botrytis stem girdling of the type described by Thomas (18) and Kadow et al. (7). High humidity resulted from the use of heated water in the tanks, greatly favoring the disease. Losses were said to have been sustained in most seasons.

Penstemon. Numerous plants of P. centranthifolius in Lompoc seed fields in April, 1940 were found to have Botrytis stem cankers. The fungus girdled stems a half inch in diameter, starting from a smaller dead lateral branch and forming an inconspicuous lesion on which there was sparse sporulation. Branches above the lesion died.

In April, 1941 plants of P. spectabilis in Riverside showed a Botrytis tip blight. Infections apparently occurred 2-4 inches back from the tip and formed conspicuous purplish-brown lesions. The tips died and curled back.

Epiphytotic, Summer of 1944

In summer, frequent fogs near the coast of southern California (13) moderate the temperature; in Los Angeles the mean monthly temperatures from May through October range from 62.2 to 71.1°F, July and August being the warmest. This cloudiness, the proximity to the ocean, and the common practice of ditch or overhead irrigation, give a moderate

summer humidity. As observed by Link, et al. (10), conditions usually are favorable for Botrytis in coastal California, and sometimes are such that serious outbreaks occur.

The summer of 1944 was the worst in recent years along the coast for Botrytis injury to field crops. Some of the features of that season are presented in Table 1 for weather stations near the area. It will be noted that there were an abnormal number of overcast days in this coastal area through the summer months and that the mean temperatures were unusually low. The percentage of possible sunlight for Los Angeles (the only reporting station) was low in May and June, and the mean relative humidity was high in May and July. The phenological data[1] are even more indicative of the season: In May "unseasonably low temperatures resulted in considerable powdery mildew on cantaloupe in the Imperial Valley, . . . necessitated considerable resulphuring of grapes and tree fruits to prevent mildew, and adversely affected the growth of some truck crops, particularly tomatoes." "The coolest June since 1927 . . . Cool, moist weather generally unfavorable for growth and maturity of crops." For July "the average temperature . . . was the lowest since 1916 . . . There was considerable cloudiness near the coast . . . Many crops were ten days to three weeks late at the end of the month." In August "crops remained from one to three weeks late in many localities because of the cool summer."

Antirrhinum. Extensive seed fields of this plant were severely damaged at Arroyo Grande and Guadalupe, some so badly they were not harvested. Infections generally started from senescent flowers and advanced through the pedicel to the rachis, which was quickly girdled. Pale brown, firm lesions with darker brown concentric bands were produced, and the flower spike wilted and later dried to a dull brown. Infection of a few flowers thus produced a heavy loss of seed. Sporulation usually was copious on the senescent flowers, but was not common on the stems.

Some loss of this sort is sustained every year and seemed to have been augmented in 1944 by two factors. (a) The humid weather prevented the drying and abscission of old flowers, some of them hanging limply for many days; the fungus also was favored by such weather. (b) Control of flower-chewing insect larvae was attempted with calcium arsenate dust. While such control had been effectively applied in less humid years without plant injury, under the moist conditions of 1944 some burning resulted and this again favored Botrytis. McWhorter (11) observed such losses in Oregon following use of a thrips spray. The tendency he reported for infections to occur on the stems at the point of transition from glabrous to hirsute has never been observed in California.

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[1] Climatological Data, California Section 48 (5,7,8,13). U.S.Dept. Commerce, Weather Bureau. 1944.

Table 1. Climatic data of summer months, 1944, for five stations in southern California[a]

Climatic factor	Month	Data and departures from normal[b]									
		San Luis Obispo		Santa Maria		Santa Barbara		Oxnard		Los Angeles	
		1944	Departure	1944	Departure	1944	Departure	1944	Departure	1944	Departure
Overcast days[c]	May	18	+10.7	24	+17.1	17	+ 7.2	0	- 6.3	25	+ 8.6
	June	18	+13.6	18	+12.3	13	+ 1.6	11	+ 2.9	20	+ 4.2
	July	17	+14.1	21	+15.7	20	+12.1	2	- 2.7	15	+ 3.9
	Aug.	7	+ 4.7	8	+ 1.4	3	- 6.1	10	+ 6.9	4	- 8.9
Mean monthly temperature (°F.)	May	57.2	- 1.2	58.0	- 0.9	59.2	- 0.6	--	--	62.4	+ 0.2
	June	60.8	- 1.2	60.6	- 1.0	61.4	- 1.2	59.2	- 2.0	63.4	- 3.0
	July	63.6	- 0.9	61.8	- 1.7	63.2	- 2.8	--	--	66.6	- 3.6
	Aug.	64.0	- 0.8	60.8	- 3.1	66.4	- 0.6	--	--	71.3	+ 0.2
Percentage possible sunshine	May									65	- 4.9
	June									71	- 7.5
	July									69	+ 0.6
	Aug.									89	+10.1
Mean relative humidity 10:30 a.m.[d]	May									54	+ 2.0
	June									54	- 3.3
	July									54	+ 2.9
	Aug.									46	- 5.5

[a] From Climatological Data, California Section. U.S. Dept. Commerce, Weather Bureau.
[b] Normal mean temperature based on 43-year average; other normals based on 10-year average, 1934-43.
[c] "Cloudy" and "partly cloudy" days.
[d] Taken at noon prior to 1942.

Occasionally in gardens in various parts of the State, snapdragon stems are girdled by Botrytis, particularly when planted close together and watered from overhead. The fungus has been observed starting from large rust pustules on the stems and from adherent leaves which have been killed by rust. In March, 1941 cuttings of snapdragons in West Los Angeles were observed to be commonly injured by a Botrytis decay of the growing points, and less frequently by a basal decay of the stem.

Wild Antirrhinums growing in the California foothills have been observed to be seriously injured by Botrytis. Plants of A. coulterianum in the Santa Monica Mountains were observed in April, 1940 to have many of the erect stems girdled 3-6 inches above the soil. Conspicuous white lesions were formed, and the stems above them died. Plants of A. cornutum grown from seed in the greenhouse in June, 1940 had conspicuous white lesions 5 inches long on many of the sprawling stems.

Attempts to control Botrytis in snapdragon seed fields by use of Fermate sprays proved futile, as they previously had on lily (5).

Lactuca. Extensive plantings of seed lettuce in Ventura County were destroyed in the summer of 1944 by Botrytis attacking the flowering panicles. One field of 100 acres was disked under and the yield of others was drastically reduced. Apparently such losses have not been observed or reported in this area before or since 1944.

The old petals adhered, as in snapdragon, instead of drying normally and dropping to the ground; there was abundant evidence of infection by Botrytis through these petals. Small drops of latex, at first fluid and white but later forming brown dry pellets, were common over the panicles. These apparently originated in part from injuries produced by movement of the heads in the frequent strong winds, but may have resulted also from feeding of undetermined insects. Many of these brown pellets were observed to be covered with sporulating Botrytis and probably invasion of the stems occurred from them. Thomas (18) found Botrytis infecting tomato stems after developing in adherent insect excreta.

When observed in August the calyx, stems, and tiny leaves of seed heads in these fields were so covered with Botrytis that clouds of spores were scattered when the plants were shaken. Many of the plants in the field had been killed in the head stage, and were covered with Botrytis; whether this fungus was involved in the death of these plants was undetermined.

An Epiphytotic of 1945

Capsicum. In April, 1945 considerable loss was sustained from

Botrytis stem canker in California Wonder Bell pepper seedlings planted at Vista and San Juan Capistrano. The plants of affected fields had been greenhouse grown in flats by a single nursery and hardened outdoors for some weeks. They were pulled, the soil shaken from the roots, and the plants packed in wet Canadian peat in slatted crates for shipment to the fields. The plants were placed in layers with the leafy tops out toward the sides of the crate. This necessitated about a 4 inch overlap of the stems and roots of the two rows of plants. The roots were covered by two bands of wet peat and other alternate layers of plants and peat placed on top of them until the crate was filled. It is significant that the lesions practically always started on the stems at the points of contact with the strip of wet peat. The plants were about 7 inches high, and the lesions uniformly were 3-5 inches from the top of the root system. The plants were allowed to remain in the crates for only 2, or at the most, 3 days before planting and during that time were kept in a cool shed.

The lesions, which were tan, sometimes with darker concentric lines, girdled the stem, causing the death of the plant tops within a few days after planting. The fungus did not advance down the stems, and most of the plants successfully sprouted again from the base. The distribution of the infected plants in the field also supplied a clue as to the source of the trouble. For example, in a machine-planted field, a row would have practically every plant infected for a distance and then abruptly show no infections. Presumably this resulted from changing crates of seedlings or at least different parts of a given crate during planting operations. From 10 to 40 percent infected plants were observed in various parts of different fields of the bell peppers. Fields of Anaheim Chili peppers, grown in the same nursery and handled in the same way, sustained no losses, and the evidence seemed convincing that they were highly resistant to Botrytis.

Bell pepper plants that had been brought in flats from other nurseries and planted in the same fields showed no stem lesions. The evidence indicated that the method of packing produced conditions very favorable for Botrytis, and that the longer the plants were so held the greater was the loss. Some of the old peat used in packing was placed in moist chambers and Botrytis developed copiously from small pieces of what appeared to be plant parts. Peat taken from the bales did not thus develop Botrytis, but leaves placed on it soon became infected. Examination of the plants growing in the greenhouses and while hardening outdoors showed an occasional dead leaf with sporulating Botrytis, but no stem infections could be found. Since the fungus is ubiquitous, its occurrence on plant parts in the nursery, or perhaps in the Canadian peat, is definitely less significant than the extremely favorable conditions for infection provided by the method of packing.

The remainder of the season the plants were packed vertically in slatted crates with the roots resting in a thin layer of moist Canadian

peat, and no further losses occurred. Other nurseries have packed bare-rooted bell peppers in the same way in sphagnum moss without Botrytis damage, and growers were inclined to attribute the loss to the Canadian peat in the instance described. A test to clarify this point failed to show any difference between the two materials in the infection of pepper stems and leaves.

Ornamental peppers, variety Celestial, were observed in January, 1940 in an Ontario glasshouse to have abundant Botrytis blight. Senescent fruits were infected and the fungus advanced into the shoots, girdling them and causing die-back. The plants had been watered from above and kept too wet in a house of high humidity.

Miscellaneous Botrytis Diseases

Begonia. Plants of the fibrous-rooted type growing outdoors in Berkeley were observed in 1940 to have Botrytis rot of the stem bases. A similar disease is fairly common on tuberous-rooted begonias under glass. Flats of tuberous begonia seedlings sometimes show circular areas killed by Botrytis. The fungus starts in a spot of excessive wetness (e.g., a point of condensation drip) and spreads by contact through close stands of succulent plants.

Callistephus. Aster flower heads sometimes show dead brown patches of petals resulting from Botrytis infections, much as reported for chrysanthemum (15). Because this crop is harvested earlier than zinnia, less damage to the seed crop is sustained. Plants grown in a Los Angeles greenhouse in early spring frequently show a basal stem canker (6) caused by Botrytis infecting through dead leaves. Prompt removal of old basal leaves has reduced the losses.

Camellia. Plants grown under lath frequently show Botrytis petal spotting. White spots are conspicuous on the petals of several colored varieties and often are confused with the spotting caused by Sclerotinia camelliae Hara. Flowers normally are produced by camellias during the winter rainy season and under such conditions it would not be surprising if exosmosis into water drops, as described by Brown (3) for petals, would occur, favoring infection.

Centaurea cyanus and C. imperialis. Plants grown in a West Los Angeles greenhouse in 1944 had severe loss from Botrytis stem rot. Sporulation was copious. The fungus commonly causes decay of flower heads of C. cyanus in seed fields and sometimes causes moldy seed. When such seed is planted in pasteurized soil it either does not germinate, or gives rise to a seedling which quickly damps off from Botrytis. In the latter case the fungus does not spread unless other seedlings are in contact with the decaying plant.

Dianthus. Senescent lower leaves of carnation plants at Mt. Eden in

September, 1940 showed tan irregular spots with concentric bands of dark brown. The fungus was sporulating copiously on the surface.

Lilium. Severe Botrytis spotting of flowers, leaves, and stems was observed on specimens from Santa Barbara in August, 1939. This disease, commonly destructive in other areas, is not very damaging in California.

Paeonia. In coastal California herbaceous peony is rarely grown, largely because of inadequate winter chilling, but also because of severe injury from Botrytis. The tree peony (Paeonia suffruticosa Andr.) is grown in northern California, but is uncommon in the southern part of the state. Botrytis has been observed to cause serious losses from stem infections of tree peony in a nursery at Hayward every year since 1939 and constitutes a limiting factor to successful use of the plant in the San Francisco Bay area. Infections usually appear to start from pruning stubs on the old pithy stems. The fungus spreads to the base of the new succulent shoot a short distance below the stub and causes it to die; the new stem turns black and presents a blighted appearance.

Pelargonium. A leaf and flower blight of the type described by Melchers (12) has been observed on plants in glasshouses and in sheltered places outdoors in southern California, particularly during rainy weather.

Petunia. Considerable losses have been sustained in seed fields in Santa Barbara County from decay of the seed capsules of ruffled and double varieties. The corolla tends to remain on the plant until dried. In the relatively humid coastal section Botrytis commonly invades the corolla after it begins to wither and advances back into the pedicel and sometimes even the main stem which it girdles. In either case the seed capsule is decayed, and in these hand-pollinated varieties, losses may be large. It has been found that, in the course of the frequent handling of the plants in pollination, removal of all the corollas that have wilted or withered will give an easy, effective, and inexpensive control of the disease. The single varieties have some stem infections, but sustain little flower damage. Seedlings of ruffled petunias growing in coldframes were found in February, 1946 to have circular areas of Botrytis decay, similar to that described for begonia above.

Primula. P. malacoides specimens received from Temple City in January, 1945 were observed to have a Botrytis decay of basal leaves similar to that reported by Spaulding (15).

Rhododendron. Flowering azaleas commonly show a Botrytis petal spotting which often is confused with that caused by Ovulinia azaleae Weiss. This is quite conspicuous on some colored varieties, producing white spots, 2-3 mm in diameter.

Ricinus. A Botrytis of the cinerea type has been observed almost every winter on castor bean plants in the University of California Botanical

Garden and other locations in West Los Angeles. Flower heads are girdled and killed by the fungus advancing from old dead stems or flower pedicels. The parts above the white lesion turn brown but remain on the plant.

Rosa. Bud blight and some stem girdling was observed in specimens from San Francisco in May, 1939. Dr. H. Earl Thomas reports that bud blight is common on the variety Belle of Portugal in Berkeley, but it does not occur commonly on rose in other parts of the State.

Salpiglossis. Plants were observed in September, 1942 in a Lompoc seed field to have, at a height of 18-24 inches above the ground, abundant white stem lesions over which Botrytis was sparsely sporulating. The whitened areas frequently had concentric brown zones; in no case were sclerotia found in the pith. This type of loss is fairly common, and sometimes infections occur on the flower pedicels.

Scabiosa. Numerous, scattered, dead and dying plants of S. columbiaria were observed in Lompoc seed fields in September, 1942 to be infected with Botrytis at soil level. These plants form numerous basal branches, some of which are shaded out or otherwise killed and apparently serve as infection courts for the fungus. The Botrytis advanced from such branches into the crown and soon killed the whole plant. Sclerotia were formed on the dead crown and roots below soil level. Such losses were undoubtedly favored by excessive water applied in ditches near the crowns. Infection of the flower heads and production of moldy seed is not uncommon in seed fields.

Sinningia and Cyclamen. These plants grown in pots have a fairly dense mass of leaves and buds at the soil surface which greatly retards drying after irrigation, and consequently the flower buds often are decayed by Botrytis while still very small. It has been found that this largely can be prevented by subirrigation, the soil surface and buds thus remaining dry and local humidity low. In a greenhouse at Colma in 1939 there was an epiphytotic of Botrytis stem rot on cyclamen, and the fungus sporulated copiously. Attempted control by removal of diseased leaf petioles proved unsuccessful. Botrytis flower spotting of the type described by Wenzl (19) was common in November. On colored varieties the spots appeared white and on white varieties they had distinctive tan margins. In a Los Agneles greenhouse there appeared in 1941 a spotting similar in appearance except that on white varieties the area was pink and on colored types it was intensified, which apparently resulted from feeding of an unidentified aphid.

Tagetes. Flower infections similar at first to those reported above for zinnia and aster, are not uncommon in seed fields. The Botrytis grows down into the stem causing it to turn white.

Tulipa. Botrytis "fire" was found on a few plants at San Lorenzo and Menlo Park in March, 1940. As this crop is not grown commonly in

much of coastal California, epiphytotics of the disease have not been observed.

Vinca. Botrytis stem canker was seen in West Los Angeles in April, 1940 on plants of V. major growing outdoors under wet conditions. Plants of V. rosea had Botrytis stem canker in Riverside in March, 1946.

Zantedeschia. Yellow callas grown for seed in a Los Angeles greenhouse showed considerable loss from Botrytis infection through the old senescent spathe, especially during cloudy weather. The trouble was almost entirely controlled by early removal of the spathe, providing better aeration of the spadix and reducing the amount of senescent tissue.

Zinnia. Flower heads of zinnia in the fall months commonly show petal blight caused by Botrytis. This usually appears on a group of several consecutive petals in a given whorl, and gives the head an imbricate or shingled appearance. Only rarely is the whole head involved, and sporulation usually is not heavy. This type of injury commonly is observed in seed fields in September and October. No varietal differences in susceptibility have been noted, but the damage is most conspicuous on whiteflowered types. Seed formed in infected areas of the heads frequently is moldy. When in 1943, because of labor shortage, harvest was unduly delayed and some plants were still in the field after heavy fogs and occasional rains began, considerable losses were sustained from development of such moldy seed.

Discussion and Summary

Observations were made on 3 field outbreaks of Botrytis cinerea in southern California. Two of these were the result of coincident favorable weather conditions: the winter of 1940-41 had rainfall more than twice normal and the usual moderate temperatures of the area; the summer of 1944 had unusually low temperature, high humidity, and numerous overcast days from May through August. One field epiphytotic resulted from infections that occurred under conditions of handling seedlings during shipment to the field.

Injury is reported on 34 cultivated and 2 wild plants.

All observations on Botrytis cinerea in California have supported the conclusion that, to become aggressively parasitic, it requires high humidity or free moisture, and that it is favored by temperatures considerably below 70°F. Infection has occurred through senescent or necrotic tissue in all cases examined except in flower petals, which apparently can be directly invaded.

Because the fungus is a facultative parasite, it is reasonable that temperatures too low to favor the host, but not sufficiently low (i.e.,

not below 41°F) markedly to reduce fungus growth, will be most favorable for disease development. It is perhaps for this reason that outbreaks occur at temperatures of 45-60°F, even though the optimum for development in tissue is 72.5-77°F.

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DIVISION OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, LOS ANGELES 24.

KNOWN DISTRIBUTION OF PHLOEM NECROSIS OF THE AMERICAN ELM

T. W. Bretz and R. U. Swingle[1]

Phloem necrosis of the American elm, a virus disease, has been known to be quite generally distributed in sections of the Ohio River valley for some time. Swingle[2] reported the distribution as follows: the southern halves of Ohio, Indiana and Illinois; southeastern Missouri; northwestern Tennessee; Kentucky; and the western part of West Virginia. Subsequently the disease was found in Jackson, Mississippi. In 1944 many trees were found to be diseased in St. Louis and Kansas City, Missouri, and limited surveys for the disease were undertaken in Missouri and Kansas. It was found in widely scattered locations in Missouri[3,4] and east-central Kansas, as far west as Topeka[5]. During the same year, phloem necrosis was found to be the cause of an epidemic dying of elms at Peoria, Illinois and to occur as far north in the Wabash River valley as Williamsport and Attica, Indiana.

Reports of suspected cases of the disease were received from Chattanooga, Tennessee, and northern Mississippi, and its occurrence in northeastern Arkansas and northeastern Oklahoma was reported recently in a letter from Howard W. Larsh, Chairman, Botany Department, University of Oklahoma. Reports were received also, indicating a northward extension of the disease area in parts of Missouri. To verify these reports and to secure additional information on distribution and recent spread of elm phloem necrosis, additional surveys were made in 1945, principally at the extremities of the area known to be involved in 1944. These surveys were not designed to be intensive nor exhaustive, but they did reveal a much wider distribution of the disease than had been previously known (Fig. 1).

The presence of elm phloem necrosis was confirmed at Chattanooga, Tennessee. Here the disease appeared to be well established, 166 infected

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[1] Pathologists, Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.

[2] Swingle, R. U. Phloem Necrosis, a Virus Disease of the American Elm. U.S. Dept. Agr. Cir. 640. 8 pp. Illus. 1942.

[3] Bretz, T. W. Phloem Necrosis of Elms in Missouri. Plant Disease Reporter 28: 929-931. 1944.

[4] _____. Further Note on Occurrence of Elm Phloem Necrosis in Missouri. Plant Disease Reporter 28: 950. 1944.

[5] Slagg, C. M. Phloem Necrosis Found on Elm in Kansas. Plant Disease Reporter 28: 1053. 1944.

Fig. 1. Known distribution of phloem necrosis of American elm in 1945.

trees having been counted in an exploratory survey of the city. This location is of interest because of its geographic location. There had been some thought that the Appalachian Range with its sparse elm population might afford a sufficient barrier to prevent the movement of the disease into the eastern coastal region. However, with the disease in Chattanooga, which is near the southern extremity of certain valleys that run northeastward and open into the East Coast region, it seems possible that an entryway for the movement of the disease into the eastern and northeastern sections of the United States is now available. No evidence has yet been obtained to indicate that the disease is spreading toward the East Coast States through the Piedmont Region. No cases of elm phloem necrosis were found during an exploratory survey this year into northern and central Alabama and Georgia.

Diseased specimens were found in Pontotoc, Mississippi, in the northern part of that State, and a survey of Jackson, Mississippi, revealed that phloem necrosis was still active at this location. Here, however, although the disease was more widely distributed through the city than it was in 1941, the number of individual trees affected had actually decreased. This is quite contrary to its behavior in other locations in the disease area, where the usual course of the disease has been one in which the number of diseased trees increases several-fold each season until the elm population has been greatly reduced.

No phloem necrosis locations were found in following the Arkansas River valley across the State of Arkansas. So far as is known, therefore, the disease is limited to the northeastern portion of that State, as reported by Larsh, and this suggests a possible movement into this area from southeastern Missouri and western Tennessee. Well established infection centers were found in the extreme southwestern section of Missouri in 1944. It is not surprising, therefore, that the disease has been found in northeastern Oklahoma (at Bartlesville and Miami), as reported by Larsh and confirmed by T. W. Bretz, nor that it is also present in Parsons, Kansas, according to information received from L. E. Melchers of Kansas State College of Agriculture. The southwestward extension of the disease from this general area remains to be determined.

An extension of the known disease area to the north and northwest of Missouri also resulted from surveys into southern Iowa and southeastern Nebraska. The disease appeared to be more or less continuous on either side of the Missouri River from Kansas City northward, for approximately 100 miles. In Nebraska, the northernmost extension is in the vicinity of Auburn, about 25 miles north of the Kansas-Nebraska border. In Iowa infected trees were found at Shenandoah but none were observed north of this city. Here the movement appears to have followed the Missouri River Valley northward and all indications are that the disease is new in this area. Although, in Missouri, phloem necrosis has been found in the north-central section, no evidence has been secured to indicate a northward movement into south-central Iowa. However, infected trees

have been found as far north as Burlington, Iowa, indicating a northward movement along the Mississippi River, for the disease is practically continuous from St. Louis, Missouri, to that city.

To summarize, phloem necrosis is now known to occur in parts of the following States: Ohio, Indiana, Illinois, Missouri, Iowa, Nebraska, Kansas, Oklahoma, Arkansas, Mississippi, Tennessee, Kentucky, and West Virginia. The disease area extends from southeastern Ohio and southeastern Tennessee westward to eastern Kansas, northeastern Oklahoma, and southeastern Nebraska. A southern projection of the area extends to Jackson, Mississippi. The northern limit is approximately along the 40th parallel, with further northward extensions along the Scioto, Wabash, Illinois, Mississippi, and Missouri River Valleys. The innumerable factors that may determine the ultimate distribution of the disease are not yet known, but it may be assumed that many disease-free locations within the present known disease area will eventually be invaded and perhaps a further outward spread of the diseese may also be anticipated.

DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

REPORT OF THE REGIONAL PEANUT SEED TREATMENT TESTS CONDUCTED IN 1945

Prepared by S. B. Fenne, Chairman
Row Crop Legume Committee

Introduction

Cooperative peanut seed treatment tests were conducted in Alabama, Georgia, Louisiana, South Carolina, and Virginia in 1945. The procedure followed was similar to that used in the previous years. All tests were replicated six times. All five cooperators used the following materials and applied them at the rates indicated per 100 pounds of seed: Arasan - 3 oz.; 2% Ceresan - 4 oz.; Spergon - 4 oz.; Dow 9-B - 2 oz.; Fermate - 3 oz.; Check - no treatment. In addition to these treatments, South Carolina, Alabama and Virginia used Dow 9 at the rate of 2 oz. per 100 lb. seed; Alabama, South Carolina, Georgia and Virginia used Yellow Cuprocide and U. S. 604 at the rates of 4 oz. and 2 oz., respectively, per 100 lbs. seed; Alabama used Merc-o-Dust at 3 oz. and 1452-F at 1 1/2 oz. per 100 lbs. seed. Machine-shelled seed was used in all tests except in Louisiana, where hand-shelled seed was planted.

The seed treatment tests were conducted by the following cooperators: C. J. Nusbaum, Blackville, South Carolina; L. H. Person, Baton Rouge, Louisiana; Coyt Wilson, Auburn, Alabama; Mrs. N. C. Woodroof, Tifton, Georgia; and S. A. Wingard and E. T. Batten, Holland, Virginia.

Effect of seed treatment on emergence of peanuts in 1945

Treatment	Percentage of emergence in									
	S. Carolina: Machine shelled Spanish	Alabama: Runner	Louisiana: Hand shelled Spanish	Georgia: Machine Spanish	Georgia: Machine C. Runner	Virginia: Machine Runner	Virginia: Hand Runner
Arasan	94.3	78.7	84.5	80.2	86.2	84.0	89.8
Spergon	90.2	81.2	77.3	75.7	87.2	84.0	85.8
2% Ceresan	95.3	79.3	93.0	84.8	87.3	85.7	88.7
Yellow Cuprocide	84.0	72.2	--	74.7	87.0	86.8	87.7
Dow 9	92.8	77.8	--	--	--	86.8	90.7
Dow 9-B	94.0	68.8	88.0	67.0	77.7	76.8	85.2
U.S. 604	93.0	80.0	--	71.2	90.5	89.0	90.7
Fermate	89.0	74.0	63.0	73.8	86.7	79.2	85.8
Merc-o-Dust	--	67.2	--	--	--		
1452-F	--	84.7	--	--	--		
Check	77.7	63.5	61.5	53.8	72.7	66.5	83.8
L.S.D.,5%*	2.7	9.4	4.7	5.5	7.0	5.5	4.8
L.S.D.,1%**	3.6	12.6	6.3	7.4	9.5	7.4	6.4

* Difference to be significant at 5% level
** Difference to be significant at 1% level

The seed used in each test came from the same source. The treatment was made by applying the dust to the seed in a closed container and shaking thoroughly. The peanuts were planted according to the general practice followed in the areas where the tests were conducted. The treated and untreated kernels were dropped by hand at the rate of 100 per plot and spaced 6 inches apart in the row.

Summary

Blackville, South Carolina:

2% Ceresan, Arasan, Dow 9-B, U. S. 604 and Dow 9 were the best. All treatments were significantly better than the check at the 1% level. 2% Ceresan, Arasan, Dow 9-B, U. S. 604 and Dow 9 were significantly better than Yellow Cuprocide and Fermate. Fermate was significantly better than Yellow Cuprocide.

Auburn, Alabama:

1452-F, Spergon, U. S. 604, 2% Ceresan, Arasan and Dow 9 were the best. At the 1% level, 1452-F, Spergon, U. S. 604, 2% Ceresan, Arasan and Dow 9 were significantly better than the check. However, there was no signif-

icant difference between these 6 treatments, nor were they significantly better than the rest of the treatments. There was no significant difference between the check and Yellow Cuprocide, Fermate, Dow 9-B, or Merc-o-Dust.

Baton Rouge, Louisiana:

2% Ceresan was the best. All treatments except Fermate were significantly better than the check at the 1% level. 2% Ceresan was better than Dow 9-B, Arasan and Spergon, and Dow 9 and Arasan were significantly better than Spergon.

Tifton, Georgia:

In the tests with Spanish seed, 2% Ceresan and Arasan were the best. All treatments were significantly better than the check at the 1% level, 2% Ceresan was significantly better than all other treatments except Arasan.

In the tests with Carolina Runners, U. S. 604, 2% Ceresan, Spergon, Yellow Cuprocide, Fermate, and Arasan were the best. All treatments except Dow 9-B were significantly better than the check; however, there was no significant difference between the other treatments.

Holland, Virginia:

In tests with machine-shelled seed, U. S. 604, Dow 9, Yellow Cuprocide, 2% Ceresan, Arasan and Spergon were the best. All treatments were significantly better than the check at the 1% level. U. S. 604, Dow 9, and Yellow Cuprocide were better than Fermate and Dow 9-B. However, there were no significant differences between U. S. 604, Dow 9, Yellow Cuprocide, 2% Ceresan, Arasan, and Spergon.

In the tests with hand-shelled seed, U. S. 604, Dow 9, Arasan, 2% Ceresan, and Yellow Cuprocide were the best. Only U. S. 604 and Dow 9 were significantly better than the check at the 1% level. There was no significant difference between any of the treatments.

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS, VIRGINIA POLYTECHNIC INSTITUTE AND THE U.S.D.A., COOPERATING. March, 1946

CONTROL OF CUCUMBER ANTHRACNOSE WITH ORGANIC FUNGICIDES: A CORRECTION

J. W. Heuberger

It has been called to the attention of the Fungicide Committee, Potomac Division, American Phytopathological Society, that an unintentional error

occurred in the 1945 report. This mimeographed report is entitled "Progress in Testing the Relative Effectiveness of New Organic Fungicides in the Control of Plant Diseases; A Summation of Nation-Wide Data in 1945".

The error appears on page 11 in the data reported for cucumber anthracnose. The report on anthracnose should be changed to read as follows:

> One test reported (La.). 10% Fermate Dust gave the best control of any material used, Dithane plus zinc sulfate-lime spray and Bordeaux spray gave the next best control, and Yellow Cuprocide and Tribasic Dust gave the poorest control.

DELAWARE AGRICULTURAL EXPERIMENT STATION. April 10.

EXPERIMENTAL FORECAST OF WHEAT LEAF RUST IN OKLAHOMA FOR 1946

K. Starr Chester and D. A. Preston

It has been shown[1] that in Oklahoma there is a good correlation between late winter or early spring weather, the amount of wheat leaf rust [Puccinia rubigo-vera var. tritici] present on April 1, and the subsequent destructiveness of rust by harvest time in June. This makes it possible to issue April 1 leaf rust forecasts which are of particular benefit to the grower whose crop is of questionable prospect in April, due to a poor stand, winter killing, or other causes, and to whom a reliable rust forecast may be the deciding factor indicating whether it is desirable to permit the crop to mature or to graze it or cut it for hay and plant a summer crop of corn, sorghum, cotton, or field legumes in its place.

The April 1 forecast is based on the concept that the rust increases by logarithmic progression from its lowest prevalence in winter to its maximum in May or June, that its epiphytotic development requires cycles of reproduction in late winter in order that the concentration be sufficiently great by April 1, that during February and March the temperature and moisture in Oklahoma are borderline, sometimes inhibiting, sometimes favoring these early reproductive cycles, and that after April 1 the moisture and temperature are regularly so favorable for rust development that ordinary weather variations from April 1 onward, when the disease first attracts attention, have little effect in altering the course of rust development that has been determined by April 1.

This view has been borne out by experiences of recent years. On April 2, 1938 a very high intensity of leaf rust was observed[2] and this was followed

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[1] Plant Disease Reporter 26: 213-217, 1942; Supp. 143, 1943; 28: 280-287, 1944; Supp. 156, 1945.

[2] Ibid. 22: 115, 1938

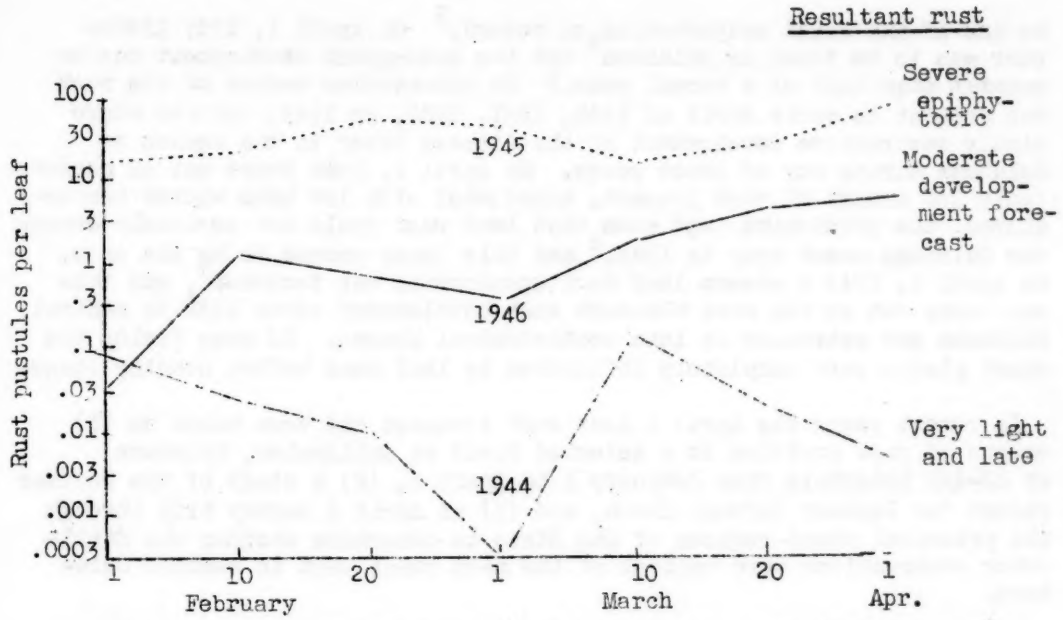

Fig. 1. Leaf rust intensity, Feb. 1 to Apr. 1, 1944-46.

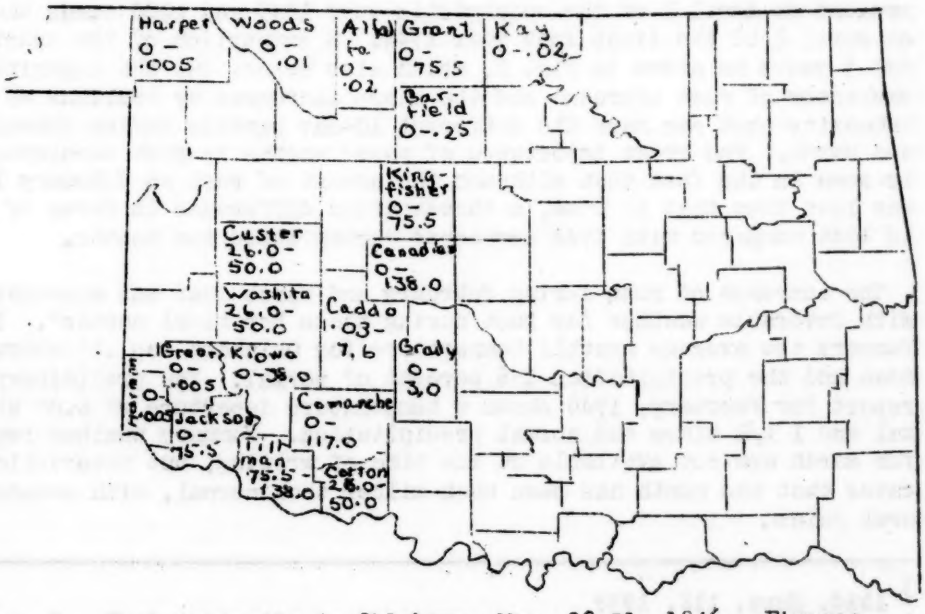

Fig. 2. Rust intensity in Oklahoma, Mar. 29-31, 1946. Figures indicate range of numbers of rust pustules per wheat leaf.

by one of the worst epiphytotics on record.[3] On April 1, 1939 little rust was to be found in Oklahoma[4] and its subsequent development was no greater than that of a normal year.[5] No outstanding amount of the rust was present in early April of 1940, 1941, 1942, or 1943, nor was there highly destructive development of the disease later in the season in Oklahoma during any of these years. On April 1, 1944 there was an exceedingly low amount of rust present, associated with low late winter temperatures; the prediction was made[6] that leaf rust could not seriously damage the Oklahoma wheat crop in 1944, and this later proved to be the case. On April 1, 1945 a severe leaf rust epiphytotic was forecast[7], and this was borne out by the most abundant rust development since 1938 in central Oklahoma and extending up into south-central Kansas. In many fields the wheat plants were completely defoliated by leaf rust before heading stage.

In recent years the April 1 leaf rust forecast has been based on (1) counts of rust pustules in a selected field at Stillwater, Oklahoma at 10-day intervals from February 1 to April 1, (2) a study of the weather record for January through March, and (3) an April 1 survey trip through the principal wheat regions of the State to determine whether the Stillwater observations were typical of the main wheat belt in central Oklahoma.

In 1946 the pustule counts slowly increased from .037 pustules per leaf February 1 to 4.7 pustules per leaf April 1, or 1/15 of the rust present on April 1 of the epiphytotic year 1945 and 1000 times the amount on April 1 of the light rust year 1944. A comparison of the count for the 3 years is given in Fig. 1, which also brings out the logarithmic character of rust increase and the sharp increases or declines of rust intensity that can mark the different 10-day periods during February and March. The great importance of these months in rust development is seen in the fact that although the amount of rust on February 1, 1946 was less than that in 1944, a thousandfold difference in favor of rust in 1946 compared with 1944 developed during these two months.

The increase of rust during February and March 1946 was associated with favorable weather for rust during these "critical months". In January the average monthly temperature for Oklahoma was .9° above the mean and the precipitation 196 percent of normal. The preliminary weather report for February, 1946 shows a temperature departure of 6.0° above normal and 1 1/2 times the normal precipitation. Summary weather reports for March are not available at the time of writing, but observation indicates that the month has been much milder than normal, with abundant general rains.

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[3] Ibid. Supp. 112, 1939
[4] Ibid. 23: 126, 1939
[5] Ibid. 23: 198, 1939
[6] Ibid. 28: 280-287, 1944
[7] Ibid. Supp. 156, 1945

On March 29-31 the junior author made a survey of the amount of rust along a route through the principal wheat counties. The region surveyed included the following Counties: Kay, Grant, Alfalfa, Woods, Harper, Garfield, Kingfisher, Grady, Canadian, Caddo, Comanche, Cotton, Tillman, Kiowa, Jackson, Harmon, Greer, Washita, Custer.

The areas mentioned above were sampled for their leaf rust content at each of sixty-three stops. Usually two adjacent fields were examined at each stop. In general the rust was light in the northern tier of counties, became increasingly worse toward the southern part of the State, and showed the greatest development in Tillman County.

The results obtained by examination of wheat in the various counties showed the following amount of leaf rust to be present, expressed as the number of rust pustules per leaf: Kay, 0 to .02; Grant, 0 to 75.5; Alfalfa, 0 to .02; Woods, 0 to .01; Harper, 0 to .005; Garfield, 0 to .25; Kingfisher, 0 to 75.5; Canadian, 0 to 138.0; Grady, 0 to 3.0; Comanche, 0 to 117.0; Cotton 26.0 to 50.0; Tillman, 75.5 to 138.0; Jackson, 0 to 75.5; Harmon, 0 to .005; Kiowa, 0 to 38.0; Greer, 0 to .005; Washita, 26.0 to 50.0; Custer, 26.0 to 50.0; Caddo, .03 to 7.6. (Figure 2).

Thus it appears that the development of rust throughout the areas surveyed is consistent with that in the field in which its development was studied in detail, and with the late winter weather record. On the basis of this study it is predicted that leaf rust in Oklahoma in 1946 will be abundant, somewhat more so than in a "normal" year, but without reaching the epiphytotic destructiveness of rust in 1938 or 1945.

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
April 1, 1946.

WHEAT LEAF RUST IN TEXAS

I. M. Atkins

Owing apparently to the combination of late emergence of grain in this area and the uniformly low night temperatures, no rust has been found on grain until the past two weeks. Leaf rust of wheat has appeared and a light general infection is now present. No other rusts have been found.

DIVISION OF CEREAL CROPS AND DISEASES, TEXAS SUBSTATION NO. 6, DENTON, TEXAS, March 15, 1946.

DISEASES OF VEGETABLE CROPS DURING MARCH IN PALM BEACH, BROWARD AND MARTIN COUNTIES, FLORIDA

G. R. Townsend, R. C. Cassell, E. L. Felix, and Russell Desrosiers

BEANS Halo blight (Phytomonas medicaginis var. phaseolicola) [Pseudomonas phaseolicola] occurred in several hundred acres of beans in scattered Everglades fields planted with seed produced in Wyoming. The loss of stand in the affected fields was estimated to be 30 percent. Heavy rains that occurred after this observation spread the disease to all plants in these fields. Idaho certified bean seed remained blight-free in adjacent fields.

Root rot (Rhizoctonia sp.) occurred in a slight amount in most fields and caused the loss of several hundred acres of beans in fields temporarily flooded by heavy rains.

Rust (Uromyces phaseoli var. typica) was seen in a few fields but was not serious except in a field of over-mature beans. The same was true of powdery mildew (Erysiphe polygoni).

CELERY Early blight (Cercospora apii) became very prevalent on celery after the heavy rains of March 14-18. Except in the fields most carefully sprayed with Bordeaux mixture the disease caused important loss. Yield reductions due to the necessity of increased stripping of blighted foliage were estimated to vary from 25 to 150 crates per acre.

Mosaic (virus) caused about 25 percent loss due to petiole discoloration, around the edges of celery fields, but only 2 percent loss was found further inside the field. Heavy losses were encountered only for 100 to 150 feet into the fields.

Traces of pencil-stripe (cause unknown) and root-knot (Heterodera marioni) were reported.

ESCAROLE The hollow heart mentioned in the December report has been found to be associated with one strain of this crop, and appears to be a genetic disorder resulting in the failure of the meristematic tissue in the crown to develop a normal bud.

EGGPLANT A trace of mosaic (virus) was observed.

Wind scars (physiogenic) have been a serious factor in eggplant production in the Coastal areas. Many fruits have been rejected by buyers because of wind scars.

Watery soft rot (Sclerotinia sclerotiorum) affected 4 percent of the

plants in a field at Pompano.

PEPPERS Mosaic (virus) was observed in many fields throughout the area. One large field in eastern Martin County had 100 percent affected plants and had been abandoned after the second picking. A seven-acre field in the Everglades that showed 65 percent infection produced good yields of excellent peppers, apparently because of late infection.

Scattered but not serious infections of early blight (Alternaria solani), bacterial spot (Xanthomonas vesicatoria) and frog-eye spot (Cercospora capsici) were noted in fields in Martin County.

POTATOES Late blight (Phytophthora infestans) has been developing on the potato fields in the Everglades since the rains of March 14-18. Growers have had difficulty in controlling it because the rains prevented spraying at critical times and because of insufficient equipment and labor. A few fields have blighted and most of the remaining fields showed too much blight at the month's end.

Early blight (Alternaria solani) has been present during the month but has caused no damage.

TOMATOES Late blight (Phytophthora infestans), continues to be prevalent in the fields along the East Coast. In the large tomato section near Dania in Broward County the picking is about three-fourths completed. Packers and shippers estimate that the crop will be reduced about 50 percent in that area. Late blight has been the greatest contributing factor in the yield reduction, although growers state that this has been a poor growing season for tomatoes and other vegetable crops on the East Coast. In Palm Beach and Martin Counties late blight has caused abandonment or replacement of many newly transplanted fields. There has probably been a greater total loss of mature fields in Martin County than in Palm Beach County.

Dithane-zinc-lime spray and Copper-A spray and dust (6% metallic copper) have been used extensively in the three counties to prevent and retard the spread of the late blight organism. Although fungicidal applications have not been regarded as satisfactory, they have proved profitable. Growers who have maintained a regular spray or dust schedule have not been able to keep the foliage free from infection, but have been able to keep the fruits relatively free and in satisfactory condition for green shipment. Foliage reduction, however, has tended to limit plant growth and indirectly to reduce yield regardless of the best spray and dusting efforts. Late blight also has been prevalent on garden plots and fields of tomatoes in the Everglades. A few growers have been successful in controlling the disease with the Dithane-Zinc-lime spray.

Leaf spot (presumably gray leaf spot, Stemphylium solani), has been observed in a few scattered fields of eastern Broward and Palm Beach Counties. Where present the disease has proved a serious defoliation menace. In the Station experimental plots on the East Coast where a four-day spray schedule was being maintained the disease appeared and spread rapidly. Bordeaux, Dithane-zinc-lime, Zerlate, and Wettable Spergon sprays, although showing some differences in the control of the disease, to date appear wholly inadequate in keeping this leaf spot in check.

Blossom-end rot (physiogenic), has been noted in a few East Coast fields during March. The most encountered was about 10 percent in one field.

Fusarium wilt (F. oxysporum f. lycopersici), although present to some extent in several Coastal fields, was found affecting up to 15 percent of Rutgers plants in a field near Delray Beach this month.

Tomato mosaic (virus) was found seriously affecting one field near Delray Beach. This was the most seriously affected field noted to date on the Coast. The extent of affected plants was hard to ascertain as plants were in all stages of development as far as symptoms were concerned. Probably a conservative estimate of 60 percent of the plants could be classified as affected. Some plants were in the typical "fern-leaf" symptom stage and individual rows were uniformly infected, evidencing spread by the sprayer. The sprayer had been through the field several times in an attempt to control a light infection of late blight.

Leaf mold (Cladosporium fulvum), was found for the first time this season on the Coast during the last week of March. A light infection was prevalent in one small planting in Palm Beach County.

SQUASH Blossom-end fruit rot (Rhizopus sp.) was seen in three fields in Martin County. Infection was running as high as 8 to 10 percent in one field.

Mosaic (virus) has become progressively more serious in the late planted fields of the Coastal area. Some fields in Broward County showed 100 percent infection and had been abandoned. The disease also was prevalent in the Everglades.

EVERGLADES EXPERIMENT STATION
April 1, 1946.

PLANT DISEASE REPORT
HOMESTEAD AREA, DADE COUNTY, FLORIDA
FALL AND WINTER SEASON 1945 - 46

Huey I. Borders

Owing to the excessive rainfall following the tropical hurricane of September 15, 1945, planting of the fall vegetable acreage in the Homestead area was delayed from four to six weeks. In addition to this flooding many farms were made unfit for agriculture by sea water which was blown in by the hurricane.

BEAN The predominant bush snapbean variety in the Homestead area is the Tendergreen, with a small acreage of Florida Belle. The main pole bean variety is Kentucky Wonder. Both are susceptible to sclerotiniose.

The greater part of the snapbean acreage was planted in November with planting completed by the fifteenth of December. Sclerotiniose of beans was found the third week in December and by the second week in January, 1946, apothecial production by Sclerotinia sclerotiorum was well under way.

Sclerotiniose was widespread throughout the area and approximately 90 percent of the bean plantings were affected in degree ranging from total loss of the crop in the field to only a few isolated plant infections. In addition to the intrinsic loss there was also the psychological effect upon the market, as buyers would refuse to buy beans from a farm where sclerotiniose was known to have occurred because of the potential loss in transit of beans in which a few infected pods might have escaped detection and been packed in the hampers.

During the first part of the season one forty-acre field of Tendergreen snapbeans sustained a 20 percent loss due to damping-off of the seedlings by Pythium root rot.

In the bean area east of the town of Goulds, Florida, approximately 120 acres of snapbeans were found to be affected with leaf spots caused by an Alternaria. The affected leaves were covered with typical Alternaria lesions, i.e., roughly circular brown necrotic areas showing concentric ring markings typical of Alternaria infections.

About 70 percent of the pole bean plantings and approximately 30 percent of the snapbean plantings were affected by bean rust (Uromyces phascoli var. typica).

POTATO The diseases affecting potato plantings in the Homestead area during the 1945-46 growing season were, in order of impor-

tance, late blight (Phytophthora infestans), sclerotiniose (Sclerotinia sclerotiorum), early blight (Alternaria solani), black leg (Erwinia carotovora), and bacterial ringrot (Corynebacterium sepedonicum). The potato varieties grown in this area are Red Bliss and Pontiac, with the acreage about equally divided between the two.

Late blight first appeared in this area in the early part of January, 1946, and caused appreciable damage to unsprayed fields and to fields where some fungicides were used.

The disease next in importance to late blight was sclerotiniose. This disease has been increasing in importance in the potato and tomato plantings in the lower East Coast area of Florida for several years and this year was more severe than in any of the previous years. In addition to the severe foliage damage some heavily infested fields were found in which the entire potato plant was killed. Approximately 75 percent of the potato plantings were affected in degree ranging from a trace to 95 percent. In addition to the damage to the potato crop from sclerotiniose the large number of sclerotia produced in the stems of infected plants afford a source of inoculum for subsequent crops.

Damage to potato foliage from early blight varied from light to moderate. There was a light damage in a few fields from blackleg.

Bacterial ring rot appeared in a few fields but amounted to only a trace in the total potato plantings in this area.

The growing season in general was not conducive to large crops. There was considerable wireworm damage this year and a heavy infestation of leaf miners (one of the Agromyzidae).

TOMATO This season tomato plantings sustained the worst attack of late blight in recent years. Late blight first appeared in tomato fields in the Homestead area during the first part of January, 1946, and within two weeks had affected approximately 90 percent of the tomato plantings. This year the disease appeared in tomato fields prior to its appearance on potatoes. Crop losses varied from a trace to total loss with average ranging about 40 percent.

The extreme virulence of the organism, and the apparent ability of the pathogen to continue to spread in the fields despite much drier and hotter weather than is normally considered possible for its development, suggests the possibility of a new physiological race of the organism.

As there had been no severe outbreak of late blight on tomatoes in the last few years, many of the growers had not started spraying and many more were not equipped to spray their plants. Many of those who did attempt to control the disease by means of a spray or dust used materials that gave little or no control. This reporter was able to control late

blight in the tomato spray test plots at Homestead by the application of dithane-zinc sulfate-lime at five-day intervals. Control was also obtained by the use of two new dithio-carbamate reaction products[1] at the same rate of application.

Approximately 40 to 50 percent of the tomato plantings showed some degree of sclerotiniose (Sclerotinia sclerotiorum). Tomato plants infected by this fungus not only suffer an intrinsic crop loss, but also constitute a source of inoculum for subsequent crops, owing to the large number of sclerotia produced on the fruits and in the stems of infected tomato plants that are deposited in the soil on the breakdown of this plant material.

Stemphylium leaf spot (Stemphylium solani Weber) was widespread throughout the area from the first week in January until the third week in March, when new lesions ceased to appear. It is hard to arrive at an estimate of the damage caused by this fungus as it appeared quite suddenly, caused severe foliage damage in some cases and general foliage damage throughout the area, and has now ceased to spread.

At the time of writing this report, March 28, 1946, early blight, (Alternaria solani) has caused only light to moderate damage in the unsprayed tomato fields.

There was a short but severe outbreak of bacterial spot (Phytomonas [Xanthomonas] vesicatoria), in the fall plantings of tomatoes on the rockland[2] in this area. The disease appeared in the first part of October in fields of tomatoes that had survived the September hurricane. Approximately 30 percent damage was sustained, but by the last week in November, the advent of the dry season brought a halt to the spread and appearance of the disease. The appearance of bacterial spot in the fall tomato crop this year marked the first time in five years that it has shown up in this area. The wet conditions consequent to the heavy rains in September and October were primarily responsible for the extremely rapid and wide dissemination of this organism.

In the Miami, Florida, area there are about five acres of tomatoes grown in hydroponic cultures. A severe outbreak of Stemphylium leaf spot in these plantings was controlled by the application of dithane-zinc sulfate-lime spray. In several of the hydroponic cultures late blight, early blight, and Cladosporium leaf mold (Cladosporium fulvum) appeared, but owing to the fact that the operators were following a regular spray

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[1] DuPont No. IN - 5446. Dithane D-14 Zinc Reaction product of Rohm and Haas.

[2] The fall plantings of tomatoes are grown on soils of the Rockdale series, which is drier and less subject to inundation during the wet season in years of normal rainfall. The winter tomato crop is grown on Perrine marl soil glades which are normally inundated during the rainy season.

schedule, these diseases were controlled and little damage was sustained.

AVOCADO AND CITRUS Because of damage from the September hurricane there was no avocado crop in this area and a very light citrus crop. All of the avocado and citrus trees in this area were damaged in varying degrees by the high winds. This damage varied from a few limbs broken and/or twisted to the entire tree broken off or blown out of the ground.

It will be at least another season before the full extent of the damage to the fruit tree plantings is apparent. At this time almost 100 percent of the damaged lime trees have been invaded by Diplodia (Diplodia natalensis).

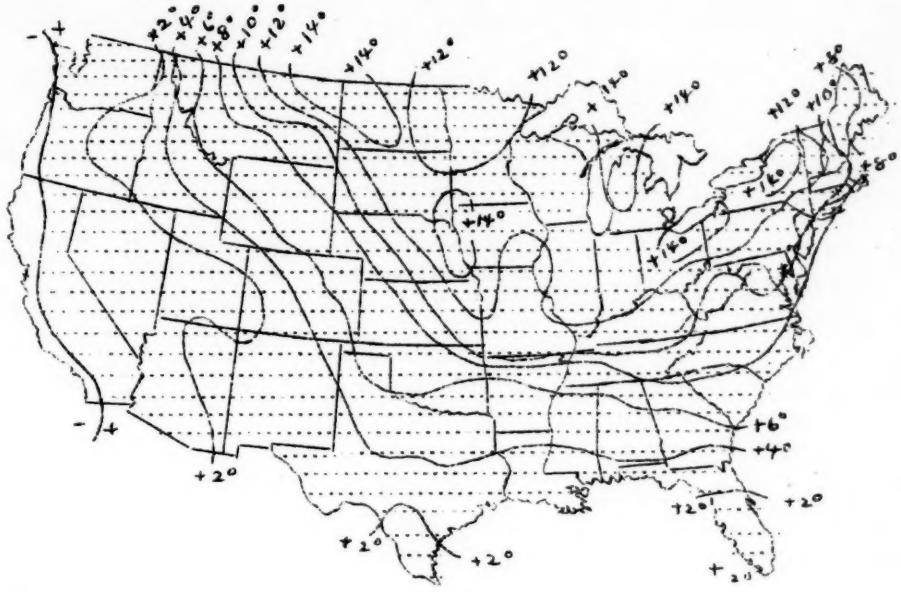
SUB-TROPICAL EXPERIMENT STATION, HOMESTEAD, FLORIDA. March 28.

MARCH WEATHER

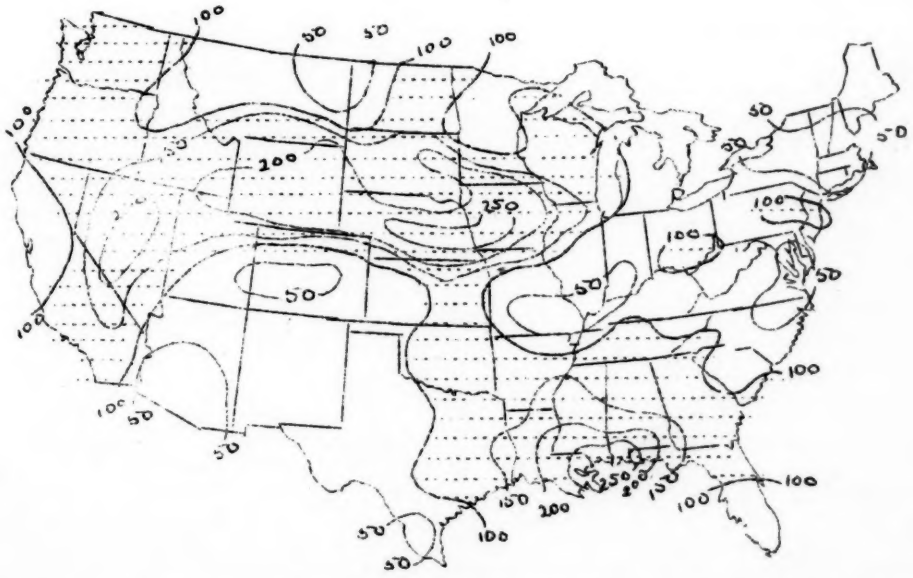
(From U. S. Department of Commerce, Weather Bureau, Weekly Weather and Crop Bulletin for week ending, April 2, 1946.)

Map I shows the departure of mean temperature from normal for March 1946. March of this year resembles in many respects the unusually warm March of last year. Temperatures averaged considerably above normal over the greater portion of the country, the exception being near to slightly below normal in Pacific coastal areas. The plus anomalies exceeded 12° in an extensive area from north-central Montana eastward almost to the New England coast and southward to the Ohio Valley and eastern Kansas.

Map II presents the areal distribution of total precipitation for March 1946. It was unusually wet in the middle Gulf States and in Nevada, Wyoming, southeastern Nebraska, Iowa, and adjacent areas, where totals for the month were more than twice their normals. From three-fourths to less than half the usual precipitation fell in most sections from Kentucky and the Carolinas to eastern Canada and in a large southwestern area.



Map I. Departure of Mean Temperature from the Normal for March 1946.



Map II. Percentage of Normal Precipitation for March 1946.